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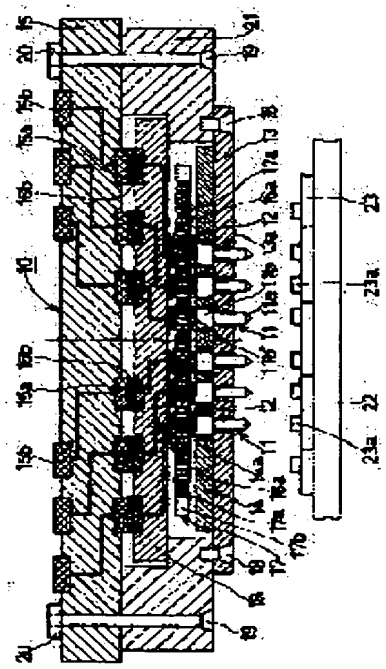
(54) PROBE CARD AND ANISOTROPIC CONDUCTIVE SHEET MANUFACTURING METHOD USED FOR THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a probe card that can deal with fine patterning of a semiconductor integrated circuit and an anisotropic conductive film manufacturing method used for the same.
SOLUTION: This probe card comprises a plurality of probe pins 11 bringing into contact with electrode pads 23a of an object under test, a circuit board 15 in which signal line patterns connected with each probe pin 11 are formed, a space spreader 16 which is installed under the circuit board 15 and on which each electrode pad 16a is arranged being opposed to each probe pin 11 on the opposite surface to the circuit board 15 and each electrode pad 16a is electrically connected to the circuit board 15, and the anisotropic conductive film 17 in which a conductive extrafine wire band 17a' is allocated, and which is arranged between the plurality of probe pins 11 and the space spreader 16 so as to electrically connect each probe pin 11 with each electrode pad 16a of the space spreader.



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CLAIMS

[Claim(s)]
[Claim 1] In the probe card for measuring many electric properties of a measuring object object The circuit board in which the signal-line pattern connected with two or more probe pins contacted to the electrode pad of a measuring object object and said each probe pin was formed, The pace spreading device with which each electrode pad which is arranged on said circuit board bottom, and opposite arrangement is carried out to each of two or more of said probe pins in the field of the opposite side with this circuit board, and is electrically connected to said circuit board was prepared, It comes to allot a conductive super-thin track group into a sheet-like base material. The probe card characterized by having the anisotropy electric conduction sheet which is arranged between said two or more probe pins and said pace spreading devices, and connects electrically each probe pin and each electrode pad of said pace spreading device, respectively.
[Claim 2] (b) The process which piles up in order the mask which drew the projection configurations of the resist film and the conductive super-thin track group arranged within the limits of diameter:10-250micrometer of a conductive extra fine wire, and pitch:30-500micrometer between conductive extra fine wires on the metal substrate, (b) by irradiating an X-ray, making an X-ray expose the part which is not covered with said mask of said resist film, and carrying out dissolution removal of this X-ray lithography part of the resist film by development from the upper part of said mask The fine structure resist film with which the configuration of a conductive super-thin track group was formed as a dissolution removal part is formed. The process which forms the conductive super-thin track group matrix which has this fine structure resist film on said metal substrate, The process which forms a conductive super-thin track group in said dissolution removal part of the fine structure resist film of said conductive super-thin track group matrix with electroforming, (Ha) Remove the surrounding resist film of the (d)-formed conductive super-thin track group, and a conductive super-thin track group is fixed in the sheet-like base material which has electric insulation and resiliency by filling up the surroundings of this conductive super-thin track group with a sheet-like base material ingredient. Next, the process which removes said metal substrate from this thing, and obtains the anisotropy electric conduction sheet before trimming processing, (e) Trimming processing of the front face and the rear face of the sheet-like base material of this obtained anisotropy electric conduction sheet before trimming processing is carried out. The manufacture approach of the anisotropy electric conduction sheet characterized by including the process which produces the anisotropy electric conduction sheet which comes to allot the conductive super-thin track group arranged by said within the limits in this sheet-like base material in the condition that the both ends of each conductive extra fine wire are exposed from a sheet-like base material into a sheet-like base material.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of the probe card of the vertical type used for measurement of many electric properties, such as an LSI chip which is a measuring object object, and the anisotropy electric conduction sheet used for it.
[0002]
[Description of the Prior Art] The probe card of the conventional vertical type used for measurement of many electric properties, such as an LSI chip As shown in drawing 5 , contact section (point) 51a of the probe pin 51 contacts electrode pad 63a of LSI chip 63 by rise of the wafer installation base 62 in which LSI chip 63 was laid. Subsequently, top-face 51b' of flange 51b formed in the head (back end section) of the probe pin 51 contacts contact section 52a at the tip of lead wire 52. And predetermined contact pressure can be given to electrode pad 63a by adding an overdrive, and many electric properties of LSI chip 63 are measured in this condition.
[0003] The probe pin 51 is inserted in through tube 54a drilled by the probe pin support plate 54 from the upper part, and is stopped by the probe pin support plate 54 by flange 51b formed in the head of the probe pin 51 more greatly than the path of through tube 54a. And the probe pin support plate 54 with which the probe pin 51 was inserted is being fixed to the lower limit of the support-saddle section 57 which hung from the circuit board 61 according to **** 55. 56 is a probe pin guide plate. Contact section 51a which disc-like flange 151b is formed in a head, and has sharpened the configuration of the probe pin 51 at the tip is formed, and dimensions are diameter:of flange80micrometer, diameter:of probe pin40-50micrometer, and die-length:1000-2000micrometer.
[0004] At the time of measurement, the through tubes 58a and 59a currently drilled by the upper support plate 58 and the bottom support plate 59 let the lead wire 52 with which contact section 52a at a tip contacts flange top-face 51b' of the probe pin 51 pass, and it is being fixed to the top face of the upper support plate 58 by the bridging 60. Connection 52b of the lead wire 52 currently fixed to the upper support plate 58 is set to connection 61a of the circuit board 61 soldering 53. Thus, when an overdrive is added by fixing lead wire 52 to upper support plate 58 top face by the bridging 60, it has prevented that the soldering 53 of connection 61a separates by the upward force of acting on lead wire 52.
[0005] Thus, the probe card of the conventional vertical type Since it is the device which the probe pin support plate 54 which inserted the probe pin 51 and stopped is ****ed, and is screwed on the lower limit of the support-saddle section 57 removable by 55, By loosening **** 55 and removing the probe pin support plate 54 from the support-saddle section 57, even when it becomes measurement impossible by damage on the probe pin 51 Since the damaged probe pins 51 or all the probe pins 51 can be exchanged and it can reproduce, the cast away of the probe card is not carried out. The above and the conventional vertical-type probe card are proposed by these people at the application for patent No. 233128 [2000 to].
[0006]
[Problem(s) to be Solved by the Invention] However, in the aforementioned probe card, it faces

assembling a probe card and the process which lets lead wire 52 pass is needed for the through tubes 58a and 59a currently drilled by the upper support plate 58 and the bottom support plate 59. This process was an activity time-consuming [of letting about 1500-5000 tungsten wires of 50-100 micrometers of wire sizes which are lead wire pass to through tubes 58a and 59a].
[0007] In order to skip said process at the time of the assembly of a probe card, it replaces with the upper support plate 58, replaces with the bottom support plate 59 using a tooth-space spreading device (tooth-space transformer homer), and the probe card which used the fabric anisotropy electric conduction sheet (INTAPOZA) which arranged the conductive thin line into the base material of the shape of a sheet which has electric insulation is known. However, when the conventional anisotropy electric conduction sheet comes to arrange a conductive thin line by the correspondence relation of one in the right above location to one probe pin to each probe pin and the arrays of a probe pin differ, the new anisotropy electric conduction sheet which arranged the conductive thin line corresponding to the array is needed. That is, the conventional anisotropy electric conduction sheet was not what corresponds to the array of a specific probe pin and can respond to the array of a probe pin which is different with the anisotropy electric conduction sheet of one sheet.
[0008] And the probe card which current and the pitch dimension of the electrode (electrode pad) of an LSI chip are less than 80 micrometers, and can respond to progress of detailed-izing of a semiconductor integrated circuit is demanded, therefore what can be arranged in 30-micrometer pitch is asked for the conductive line with a diameter of 10 micrometers as an anisotropy electric conduction sheet.
[0009] This invention is made in view of such a situation, and aims at offering the manufacture approach of the anisotropy electric conduction sheet used for the probe card and it which can respond to detailed-ization of a semiconductor integrated circuit.
[0010]
[Means for Solving the Problem] In order to attain the aforementioned purpose, invention of claim 1 In the probe card for measuring many electric properties of a measuring object object The circuit board in which the signal-line pattern connected with two or more probe pins contacted to the electrode pad of a measuring object object and said each probe pin was formed, The pace spreading device with which each electrode pad which is arranged on said circuit board bottom, and opposite arrangement is carried out to each of two or more of said probe pins in the field of the opposite side with this circuit board, and is electrically connected to said circuit board was prepared, It comes to allot a conductive super-thin track group into a sheet-like base material. It is the probe card characterized by having the anisotropy electric conduction sheet which is arranged between said two or more probe pins and said pace spreading devices, and connects electrically each probe pin and each electrode pad of said pace spreading device, respectively.
[0011] Invention of claim 2 on a (b) metal substrate The resist film and diameter:10-250micrometer of a conductive extra fine wire, The pitch between conductive extra fine wires : The process which piles up in order the mask describing the projection configuration of the conductive super-thin track group arranged within the limits of 30-500 micrometers, (b) by irradiating an X-ray, making an X-ray expose the part which is not covered with said mask of said resist film, and carrying out dissolution removal of this X-ray lithography part of the resist film by development from the upper part of said mask The fine structure resist film with which the configuration of a conductive super-thin track group was formed as a dissolution removal part is formed. The process which forms the conductive super-thin track group matrix which has this fine structure resist film on said metal substrate, The process which forms a conductive super-thin track group in said dissolution removal part of the fine structure resist film of said conductive super-thin track group matrix with electroforming, (Ha) Remove the surrounding resist film of the (d)-formed conductive super-thin track group, and a conductive super-thin track group is fixed in the sheet-like base material which has electric insulation and resiliency by filling up the surroundings of this conductive super-thin track group with a sheet-like base material ingredient. Next, the process which removes said metal substrate from this thing, and obtains the anisotropy electric conduction sheet before trimming processing, (e) Trimming

processing of the front face and the rear face of the sheet-like base material of this obtained anisotropy electric conduction sheet before trimming processing is carried out. It is the manufacture approach of the anisotropy electric conduction sheet characterized by including the process which produces the anisotropy electric conduction sheet which comes to allot the conductive super-thin track group arranged by said within the limits in this sheet-like base material in the condition that the both ends of each conductive extra fine wire are exposed from a sheet-like base material into a sheet-like base material.

[0012]

[Embodiment of the Invention] Drawing 1 is the typical sectional view showing the configuration of flow BUKADO by 1 operation gestalt of this invention.

[0013] As shown in drawing 1 , the probe card 10 of the vertical type by the gestalt of this operation It is for measuring many electric properties of LSI chip 23 which is a measuring object object. Contact section 11a of the probe pin 11 contacts electrode pad 23a of LSI chip 23 by rise of the wafer installation base 22 in which LSI chip 23 was laid. Predetermined contact pressure can be given to electrode pad 23a by adding an overdrive, and many electric properties of LSI chip 23 are measured in this condition.

[0014] The probe pin 11 is perpendicularly inserted from the upper part at through tube 13a drilled by the probe pin support plate 13, and is stopped by the probe pin support plate 13 by flange 11b formed in the head of the probe pin 11 more greatly than the path of said through tube 13a. Said through tube 13a in which the probe pin 11 is inserted is made in agreement with the location of electrode pad 23a of LSI chip 23 which should be measured, and is perpendicularly drilled to the field of the probe pin support plate 13. Moreover, as shown in drawing 1 , the probe pin guide plate 14 in which through tube 14a in which flange 11b of the probe pin 11 is inserted was drilled is provided in probe pin support plate 13 top face. Thereby, the probe pin 11 contacts so that it may become perpendicular to electrode pad 23a of LSI chip 23, and it stabilizes the location of the probe pin 11 by the probe pin guide plate 14.

[0015] 17 is an anisotropy electric conduction sheet and is the thing of structure which allotted conductive super-thin track group 17a' into sheet-like base material 17b of the rectangle which has electric insulation and resiliency. While each conductive extra-fine-wire 17a which constitutes conductive super-thin track group 17a' of this anisotropy electric conduction sheet 17 is prolonged at right angles to the thickness direction (the vertical direction in drawing 1) of sheet-like base material 17b, the both ends of each of that conductive extra fine wire are exposed, respectively from the front face and the rear face of sheet-like base material 17b. And with this operation gestalt, two or more conductivity extra-fine-wire 17a projected from the rear face of the anisotropy electric conduction sheet 17 in this probe pin 11 location is made flange top-face 11b' of each probe pin 11 soldering 12, and this probe pin 11 and said two or more conductivity extra-fine-wire 17a of the location corresponding to this are electrically connected to it. And the probe pin support plate 13 with which the probe pin 11 was inserted is screwed on the lower limit of the support-saddle section 21 by **** 18. In addition, contact section 11a which disc-like flange 11b is formed in a head, and has sharpened the configuration of the probe pin 11 at the tip is formed.

[0016] About soldering of this probe pin 11 and two or more conductivity extra-fine-wire 17a in every probe pin 11 The probe pin 11 which welded [flange top-face 11b] solder beforehand After inserting and stopping from the upper part to through tube 13a drilled in the probe pin support plate 13, Lay the anisotropy electric conduction sheet 17 on the probe pin 11, and the upward force is applied from contact section 11a of the probe pin 11. By contacting the conductive extra-fine-wire 17a edge exposed to flange top-face 11b' which solder welds from the rear face of the anisotropy electric conduction sheet 17 (it has projected), and heating the probe pin 11 from a lower part in this condition Or by energizing between the probe pin 11 and said conductive extra-fine-wire 17a, and melting solder, flange top-face 11b' of the probe pin 11 and said conductive extra-fine-wire 17a are carried out soldering 12.

[0017] When exchanging the probe pin 11 which was damaged and became measurement impossible, the anisotropy electric conduction sheet 17 and each probe pin 11 can be separated by heating each probe pin 11 from a lower part, and melting a solder part. Then, the probe pin

which became measurement impossible is exchanged to a new thing. Therefore, in the probe card 10 incorporating the anisotropy electric conduction sheet 17, since the damaged probe pins or all the probe pins can be exchanged and it can reproduce, the cast away of probe card 10 the very thing haves to be carried out.

[0018] this invention — starting — an anisotropy — electric conduction — a sheet — 17 — mentioning later — as — for example, — a diameter — 20 — micrometer — conductivity — an extra fine wire — 17 — a — 40 — micrometer — a pitch — having arranged — although — a case — drawing 4 — being shown — as — a probe — a pin — 11 — a diameter — about — 80 — micrometer — a flange — a top face — 11 — b — ' — **** — always — a sound condition — several — a ** — conductivity — an extra fine wire — 17 — a — contacting — ******** . Therefore, this anisotropy electric conduction sheet 17 can be used, without being influenced by the array of the probe pin 11.

[0019] And the anisotropy electric conduction sheet 17 concerning this invention can be used by doubling with the location of each probe pin 11 corresponding to these the location of each electrode pad 16a by the side of the inferior surface of tongue of the tooth-space spreading device (tooth-space transformer) 16 used in piles on the anisotropy electric conduction sheet 17, and doubling the diameter dimension of electrode pad 16a with the diameter of flange 11b of the probe pin 11.

[0020] About the assembly of a probe card 10, as mentioned above, the conductive extra-fine-wire 17a edge exposed to flange top-face 11b' of the probe pin 11 from the inferior surface of tongue of the anisotropy electric conduction sheet 17 is soldered, each probe pin 11 is fixed on the anisotropy electric conduction sheet 17, the probe pin support plate 13 in which each of this probe pin 11 was inserted is ****ed, and it screws on support-saddle section 21 lower limit by 18. And said support-saddle section 21 is fixed [the tooth-space spreading device 16 supported in the support-saddle section 21] for superposition and each inferior-surface-of-tongue lateral electrode pad 15of the circuit board 15 corresponding to [subsequently to a it top lay the circuit board 15, and] each top-face lateral electrode pad 16b [of the tooth-space spreading device 16], and these a with a male screw 19 and a female screw 20 superposition and after an appropriate time on the anisotropy electric conduction sheet 17 on the circuit board 15 inferior surface of tongue. thereby, it can set to each probe pin 11 and the circuit board 15 — this — each top-face lateral electrode pad 15b corresponding to each [these] probe pin 11 will be connected electrically.

[0021] In addition, as for the quality of the material of the probe pin 11, what has comparatively low electric resistance is good with metals which cannot oxidize easily below 200 degrees C, such as a palladium alloy, a beryllium copper alloy, an iridium alloy, nickel, a nickel alloy, and a rhodium alloy. Moreover, the quality of the material of the probe pin support plate 13 and the probe pin guide plate 14 is the ceramics. The quality of the material of screw threads 18, 19, and 20 is stainless steel, and the quality of the material of the support-saddle section 21 is stainless steel or the ceramics.

[0022] Thus, the probe pin 11 two or more (many) contacted so that it may become perpendicular [this probe card 10] to electrode pad 23a of LSI chip 23 which is a measuring object object, The circuit board 15 of one sheet in which the signal-line pattern connected with each of these probe pins 11 was formed, The pace spreading device 16 of one sheet with which it was allotted to this circuit board 15 bottom, and each electrode pad 16a which opposite arrangement is carried out right above, and is electrically connected to said circuit board 15 to each of said probe pin [two or more (many)] 11 was prepared in the field of the opposite side in this circuit board 15, It comes to have conductive super-thin track group 17a' in sheet-like base material 17b. It has the anisotropy electric conduction sheet 17 of one sheet which is arranged between said probe pins [two or more (many)] 11 and said pace spreading devices 16, and connects electrically each probe pin 11 and each electrode pad 16a of said pace spreading device 16, respectively, and is constituted.

[0023] Drawing 2 is a typical sectional view for explaining the procedure of the manufacture approach of the anisotropy electric conduction sheet by 1 operation gestalt of this invention.

[0024] The manufacture approach of the anisotropy electric conduction sheet concerning this

invention produces said anisotropy electric conduction sheet 17 using a LIGA (Lithograph Galvanoformung und Abformung) process. As everyone knows, a LIGA process is the production approach of the molding of the fine structure, and is a process including the deep dirty X-ray-lithography process of irradiating an X-ray at the particular part on the resist film, removing an X-ray lithography part from the resist film, and obtaining the fine structure resist film of negative structure, and the electrocasting process which obtains fine structure metal molding with electroforming into said removal part of this fine structure resist film.

[0025] In this operation gestalt, first, as shown in (a) of drawing 2 , the resist film 25 of uniform thickness with a thickness of 200 micrometers is formed on the rectangular metal substrate 24 with a thickness 0.5x width-of-face 30x die length of 30mm. Copper was used for the ingredient of the metal substrate 24 from the point which is made not to be eaten away by a conductive point and the conductive below-mentioned electrocasting liquid (plating liquid). Polymethylmethacrylate resin (PMMA resin) was used for the resist ingredient used for the resist film 25. On the metal substrate 24, this PMMA resin was applied, the resist film 25 was formed, and desiccation of 4 hours was performed in ordinary temperature after that.

[0026] As shown in (b) of drawing 2 , on the resist film 25 Next, diameter:10-250micrometer of conductive extra-fine-wire 17a, The mask 26 describing the projection configuration of conductive super-thin track group 17a' arranged within the limits of 30-500 micrometers The pitch between conductive extra-fine-wire 17a (spacing distance) : in piles An X-ray is irradiated from the perpendicular direction upper part of a mask 26, and an X-ray is made to expose the part which is not covered with the mask 26 of the resist film 25. In this example, the mask 26 describing the projection configuration of conductive super-thin track group 17a' arranged by diameter:20micrometer of conductive extra-fine-wire 17a and pitch:40micrometer of conductive extra-fine-wire 17a was used. A mask 26 is the Germany Karlsruhe [for example,] thing. As an X-ray used at this deep dirty X-ray-lithography process, while excelling in reinforcement and directivity, it is desirable to use a synchrotron radiation X-ray from the point that the configuration precision of the resist side-attachment-wall side of fine structure resist film 25' obtained is excellent. Subsequently, by carrying out dissolution removal of the X-ray lithography part of the resist film 25 by development the fine structure resist film 25 with which the configuration of conductive super-thin track group 17a' where the value of the aspect ratio (die length/diameter) (value) of each conductive extra-fine-wire 17a was 10 was formed as a dissolution removal part -- ' -- forming -- The conductive super-thin track group matrix 27 which comes to have fine structure resist film 25' is formed on the metal substrate 24 (refer to (c) of drawing 2).

[0027] next -- drawing 2 -- (-- d --) -- being shown -- as -- conductivity -- super-thin -- a track group -- a matrix -- 27 -- the fine structure -- a resist -- the film -- 25 -- ' -- said -- the dissolution -- removal -- a part -- electroforming -- each -- conductivity -- an extra fine wire -- 17 -- a -- a book -- an example -- **** -- nickel -- becoming -- conductivity -- super-thin -- a track group -- 17 -- a -- ' -- forming . In this electrocasting process, into the plating liquid 29 in a plating bath 28 (sulfamic acid bath), it was immersed, the conductive super-thin track group matrix 27 was used as the electrode by the side of plus of the nickel electrode 30, and electrocasting was performed as an electrode by the side of minus of the metal substrate 24. In this case, in order for plating liquid 29 to make it easy to invade into the dissolution removal part (conductive extra-fine-wire formation part) of fine structure resist film 25' and to form healthy conductive super-thin track group 17a', it is desirable to pressurize plating liquid 29 or to supply plating liquid 29 in the shape of a shower. In addition, conductive super-thin track group 17a' formed by electroforming has good things, such as a product made from nickel from a conductive point, copper, and a product made from a nickel cobalt alloy.

[0028] Dissolution removal of the resist film with which after a electrocasting process and the surroundings of said formed conductive super-thin track group 17a' remain is carried out, and that by which conductive super-thin track group 17a' was formed on the metal substrate 24 is obtained. Next, as this thing was held in shuttering 31 and it was shown in (f) of drawing 2 , by filling up silicone resin into the surroundings of conductive super-thin track group 17a' with this example as sheet-like base material ingredient (sheet-like base material material) 17b', and

stiffening this, into sheet-like base material 17b made of silicone resin, it came to fix conductive super-thin track group 17a', and thing production was carried out on the metal substrate 4. With electric insulation, sheet-like base material 17b has the resiliency for easing contact pressure when the probe pin 11 contacts electrode pad 23a of LSI chip 23, and silicone resin, silicone rubber (silicone rubber), etc. can be used for it.

[0029] Next, the metal substrate 24 is removed from said produced thing, and the anisotropy electric conduction sheet before trimming processing (illustration abbreviation) is obtained. In addition, in the process of said drawing 2 (f), before being filled up with silicone resin, the remover for metal substrate separation is applied to the front face of the metal substrate 24. And as trimming processing of the front face and the rear face of sheet-like base material 17b of this obtained anisotropy electric conduction sheet before trimming processing is carried out with an excimer laser and it is shown in (g) of drawing 2 The anisotropy electric conduction sheet 17 which comes to have conductive super-thin track group 17a' arranged in said pitch in this sheet-like base material 17b in the condition that about 10 micrometers of each of both ends of each conductive extra-fine-wire 17a are exposed by this example from sheet-like base material 17b into sheet-like base material 17b was produced. Since an edge is exposed on the other hand in each conductive extra-fine-wire 17a from a sheet-like base material 17b inferior surface of tongue (rear face) and the another side edge is exposed from the sheet-like base material 17b top face (front face) With this anisotropy electric conduction sheet 17, soldering of the conductive extra-fine-wire 17a edge and flange top-face 11b' of the probe pin 11 which have been exposed from the sheet-like base material 17b inferior surface of tongue can be ensured. Moreover, contact to the conductive extra-fine-wire 17a edge and inferior-surface-of-tongue lateral electrode pad 16a of the tooth-space spreading device 16 which have been exposed from the sheet-like base material 17b top face is made certainly. In addition, in order that the edge which has exposed each conductive extra-fine-wire 17a may be ground and sharpened and may lower electric resistance, it may be made to gold-plate if needed at this edge.

[0030] Thus, the anisotropy electric conduction sheet 17 is producible using a LIGA process. In addition, since the sensitization thickness of the resist film 25 by 1 time of X-ray irradiation is about 200 micrometers, here If it is going to obtain the anisotropy electric conduction sheet [that the die length of each conductive extra-fine-wire 17a is longer than 200 micrometers (that is, ten or more are the aspect ratio when a diameter is 10-20 micrometers)] 17 Although conductive super-thin track group 17a' obtained by (d) of drawing 2 was formed, upwards, the resist film 25 is formed again. And an X-ray is irradiated on a mask 26 from the upper part of this mask 26 in piles on this resist film 25, and what formed fine structure resist film 25' further upwards although conductive super-thin track group 17a' obtained by (d) of drawing 2 was formed can be produced by carrying out dissolution removal of the X-ray lithography part of this resist film 25 by development. And by carrying out in order the electrocasting process mentioned above and a trimming process henceforth, the die length of each conductive extra-fine-wire 17a can produce the anisotropy electric conduction sheet 17 which has conductive super-thin track group 17a' which is about 400 micrometers.

[0031] Drawing 3 is a typical sectional view for explaining other production approaches of the conductive super-thin track group matrix in the manufacture approach of the anisotropy electric conduction sheet concerning this invention. Comparatively high costs start formation of fine structure resist film 25' by X-ray irradiation. Then, it is possible to produce the conductive super-thin track group matrix of the 2nd henceforth, using that by which conductive super-thin track group 17a' was formed on the metal substrate 24 obtained in (e) of said drawing 2 as a male mold. As shown in drawing 3 , on one side of the metal substrate 24 namely, after forming the film 32 for conductive super-thin track group formation which consists of PMMA resin, applying heat to this and this film 32 for formation having become soft, [for example,] drawing 3 — (— a —) — being shown — as — said — a male — a mold — pushing — things — drawing 3 — (— b —) — being shown — as — a metal — a substrate — 24 — a top — the fine structure — the film — 32 — ' — having — becoming — conductivity — super-thin — a track group — a matrix — 27 — ' — being producible .

[0032] In the anisotropy electric conduction sheet concerning this invention Diameter:10-

250micrometer of a conductive extra fine wire, Since it has the conductive super-thin track group arranged by within the limits with a pitch [between conductive extra fine wires] of d:30-500 micrometers, as shown in drawing 4 , in the example of the book which arranged each conductivity with a diameter of 20 micrometers extra-fine-wire 17a in the pitch of d= 40 micrometers, for example Flange top-face 11b' (diameter of 80 micrometers) of the probe pin 11 will always contact several conductivity extra-fine-wire 17a by the sound condition. Incidentally, 10000 or more conductive extra-fine-wire 17a will be arranged by the anisotropy electric conduction sheet 17 of 5mm angle.

[0033] In addition, although conductive extra-fine-wire 17a is arranged in the anisotropy electric conduction sheet 17 by said operation gestalt so that it may extend perpendicularly along the thickness direction of sheet-like base material 17b In order to ease the force of joining conductive extra-fine-wire 17a at the time of an overdrive on the occasion of contact to the probe pin 11 and electrode pad 23a of LSI chip 23 irradiating an X-ray from the slanting upper part at the resist film 25 at the time of anisotropy electric conduction sheet 17 manufacture -- the shape of a sheet -- conductive extra-fine-wire 17a is made to incline to base material 17b page, and you may make it arrange Whenever [tilt-angle / at this time] receives perpendicularly, and its less than 60 degrees are desirable. moreover, the phase shown in (e) of drawing 2 in order to lower the electric resistance of this conductive super-thin bar-chart side, since a current will flow the front face of conductive extra-fine-wire 17a, if the RF signal current is used for measurement of many electric properties of LSI chip 23 -- the front face of each conductive extra-fine-wire 17a -- gold -- or it may be made to carry out silver plating.

[0034]

[Effect of the Invention] As stated above, according to the manufacture approach of the anisotropy electric conduction sheet by this invention, by using a LIGA process The conductive super-thin track group matrix which has the fine structure resist film is formed on a metal substrate. Since a conductive super-thin track group is formed using this conductive super-thin track group matrix with electroforming Unlike the former, it has the fine structure which comes to allot a conductive super-thin track group into a sheet-like base material, and the anisotropy electric conduction sheet which is used for a probe card and can respond to detailed-ization of a semiconductor integrated circuit can be manufactured.

[0035] According to the probe card by this invention, with this anisotropy electric conduction sheet, since it has the anisotropy electric conduction sheet which comes to allot a conductive super-thin track group into a sheet-like base material, while being able to respond to the increment in the number of probe pins, and narrow-izing of the pitch between that probe pin, it is not necessary to remake also to array modification of a probe pin each time, has versatility, and, thereby, can respond to detailed-ization of a semiconductor integrated circuit.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the manufacture approach of the probe card of the vertical type used for measurement of many electric properties, such as an LSI chip which is a measuring object object, and the anisotropy electric conduction sheet used for it.

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PRIOR ART

[Description of the Prior Art] The probe card of the conventional vertical type used for measurement of many electric properties, such as an LSI chip As shown in drawing 5 , contact section (point) 51a of the probe pin 51 contacts electrode pad 63a of LSI chip 63 by rise of the wafer installation base 62 in which LSI chip 63 was laid. Subsequently, top-face 51b' of flange 51b formed in the head (back end section) of the probe pin 51 contacts contact section 52a at the tip of lead wire 52. And predetermined contact pressure can be given to electrode pad 63a by adding an overdrive, and many electric properties of LSI chip 63 are measured in this condition.
[0003] The probe pin 51 is inserted in through tube 54a drilled by the probe pin support plate 54 from the upper part, and is stopped by the probe pin support plate 54 by flange 51b formed in the head of the probe pin 51 more greatly than the path of through tube 54a. And the probe pin support plate 54 with which the probe pin 51 was inserted is being fixed to the lower limit of the support-saddle section 57 which hung from the circuit board 61 according to **** 55. 56 is a probe pin guide plate. Contact section 51a which disc-like flange 151b is formed in a head, and has sharpened the configuration of the probe pin 51 at the tip is formed, and dimensions are diameter:of flange80micrometer, diameter:of probe pin40-50micrometer, and die-length:1000-2000micrometer.
[0004] At the time of measurement, the through tubes 58a and 59a currently drilled by the upper support plate 58 and the bottom support plate 59 let the lead wire 52 with which contact section 52a at a tip contacts flange top-face 51b' of the probe pin 51 pass, and it is being fixed to the top face of the upper support plate 58 by the bridging 60. Connection 52b of the lead wire 52 currently fixed to the upper support plate 58 is set to connection 61a of the circuit board 61 soldering 53. Thus, when an overdrive is added by fixing lead wire 52 to upper support plate 58 top face by the bridging 60, it has prevented that the soldering 53 of connection 61a separates by the upward force of acting on lead wire 52.
[0005] Thus, the probe card of the conventional vertical type Since it is the device which the probe pin support plate 54 which inserted the probe pin 51 and stopped is ****ed, and is screwed on the lower limit of the support-saddle section 57 removable by 55, By loosening **** 55 and removing the probe pin support plate 54 from the support-saddle section 57, even when it becomes measurement impossible by damage on the probe pin 51 Since the damaged probe pins 51 or all the probe pins 51 can be exchanged and it can reproduce, the cast away of the probe card is not carried out. The above and the conventional vertical-type probe card are proposed by these people at the application for patent No. 233128 [2000 to].

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] As stated above, according to the manufacture approach of the anisotropy electric conduction sheet by this invention, by using a LIGA process The conductive super-thin track group matrix which has the fine structure resist film is formed on a metal substrate. Since a conductive super-thin track group is formed using this conductive super-thin track group matrix with electroforming Unlike the former, it has the fine structure which comes to allot a conductive super-thin track group into a sheet-like base material, and the anisotropy electric conduction sheet which is used for a probe card and can respond to detailed-ization of a semiconductor integrated circuit can be manufactured.
[0035] According to the probe card by this invention, with this anisotropy electric conduction sheet, since it has the anisotropy electric conduction sheet which comes to allot a conductive super-thin track group into a sheet-like base material, while being able to respond to the increment in the number of probe pins, and narrow-izing of the pitch between that probe pin, it is not necessary to remake also to array modification of a probe pin each time, has versatility, and, thereby, can respond to detailed-ization of a semiconductor integrated circuit.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in the aforementioned probe card, it faces assembling a probe card and the process which lets lead wire 52 pass is needed for the through tubes 58a and 59a currently drilled by the upper support plate 58 and the bottom support plate 59. This process was an activity time-consuming [of letting about 1500-5000 tungsten wires of 50-100 micrometers of wire sizes which are lead wire pass to through tubes 58a and 59a].
[0007] In order to skip said process at the time of the assembly of a probe card, it replaces with the upper support plate 58, replaces with the bottom support plate 59 using a tooth-space spreading device (tooth-space transformer homer), and the probe card which used the fabric anisotropy electric conduction sheet (INTAPOZA) which arranged the conductive thin line into the base material of the shape of a sheet which has electric insulation is known. However, when the conventional anisotropy electric conduction sheet comes to arrange a conductive thin line by the correspondence relation of one in the right above location to one probe pin to each probe pin and the arrays of a probe pin differ, the new anisotropy electric conduction sheet which arranged the conductive thin line corresponding to the array is needed. That is, the conventional anisotropy electric conduction sheet was not what corresponds to the array of a specific probe pin and can respond to the array of a probe pin which is different with the anisotropy electric conduction sheet of one sheet.
[0008] And the probe card which current and the pitch dimension of the electrode (electrode pad) of an LSI chip are less than 80 micrometers, and can respond to progress of detailed-izing of a semiconductor integrated circuit is demanded, therefore what can be arranged in 30-micrometer pitch is asked for the conductive line with a diameter of 10 micrometers as an anisotropy electric conduction sheet.
[0009] This invention is made in view of such a situation, and aims at offering the manufacture approach of the anisotropy electric conduction sheet used for the probe card and it which can respond to detailed-ization of a semiconductor integrated circuit.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order to attain the aforementioned purpose, invention of claim 1 In the probe card for measuring many electric properties of a measuring object object The circuit board in which the signal-line pattern connected with two or more probe pins contacted to the electrode pad of a measuring object object and said each probe pin was formed, The pace spreading device with which each electrode pad which is arranged on said circuit board bottom, and opposite arrangement is carried out to each of two or more of said probe pins in the field of the opposite side with this circuit board; and is electrically connected to said circuit board was prepared, It comes to allot a conductive super-thin track group into a sheet-like base material. It is the probe card characterized by having the anisotropy electric conduction sheet which is arranged between said two or more probe pins and said pace spreading devices, and connects electrically each probe pin and each electrode pad of said pace spreading device, respectively.
[0011] Invention of claim 2 on a (b) metal substrate The resist film and diameter:10-250micrometer of a conductive extra fine wire, The pitch between conductive extra fine wires : The process which piles up in order the mask describing the projection configuration of the conductive super-thin track group arranged within the limits of 30-500 micrometers, (b) by irradiating an X-ray, making an X-ray expose the part which is not covered with said mask of said resist film, and carrying out dissolution removal of this X-ray lithography part of the resist film by development from the upper part of said mask The fine structure resist film with which the configuration of a conductive super-thin track group was formed as a dissolution removal part is formed. The process which forms the conductive super-thin track group matrix which has this fine structure resist film on said metal substrate, The process which forms a conductive super-thin track group in said dissolution removal part of the fine structure resist film of said conductive super-thin track group matrix with electroforming, (Ha) Remove the surrounding resist film of the (d)-formed conductive super-thin track group, and a conductive super-thin track group is fixed in the sheet-like base material which has electric insulation and resiliency by filling up the surroundings of this conductive super-thin track group with a sheet-like base material ingredient. Next, the process which removes said metal substrate from this thing, and obtains the anisotropy electric conduction sheet before trimming processing, (e) Trimming processing of the front face and the rear face of the sheet-like base material of this obtained anisotropy electric conduction sheet before trimming processing is carried out. It is the manufacture approach of the anisotropy electric conduction sheet characterized by including the process which produces the anisotropy electric conduction sheet which comes to allot the conductive super-thin track group arranged by said within the limits in this sheet-like base material in the condition that the both ends of each conductive extra fine wire are exposed from a sheet-like base material into a sheet-like base material.
[0012]
[Embodiment of the Invention] Drawing 1 is the typical sectional view showing the configuration of flow BUKADO by 1 operation gestalt of this invention.
[0013] As shown in drawing 1 , the probe card 10 of the vertical type by the gestalt of this operation It is for measuring many electric properties of LSI chip 23 which is a measuring object

object. Contact section 11a of the probe pin 11 contacts electrode pad 23a of LSI chip 23 by rise of the wafer installation base 22 in which LSI chip 23 was laid. Predetermined contact pressure can be given to electrode pad 23a by adding an overdrive, and many electric properties of LSI chip 23 are measured in this condition.

[0014] The probe pin 11 is perpendicularly inserted from the upper part at through tube 13a drilled by the probe pin support plate 13, and is stopped by the probe pin support plate 13 by flange 11b formed in the head of the probe pin 11 more greatly than the path of said through tube 13a. Said through tube 13a in which the probe pin 11 is inserted is made in agreement with the location of electrode pad 23a of LSI chip 23 which should be measured, and is perpendicularly drilled to the field of the probe pin support plate 13. Moreover, as shown in drawing 1 , the probe pin guide plate 14 in which through tube 14a in which flange 11b of the probe pin 11 is inserted was drilled is provided in probe pin support plate 13 top face. Thereby, the probe pin 11 contacts so that it may become perpendicular to electrode pad 23a of LSI chip 23, and it stabilizes the location of the probe pin 11 by the probe pin guide plate 14.

[0015] 17 is an anisotropy electric conduction sheet and is the thing of structure which allotted conductive super-thin track group 17a' into sheet-like base material 17b of the rectangle which has electric insulation and resiliency. While each conductive extra-fine-wire 17a which constitutes conductive super-thin track group 17a' of this anisotropy electric conduction sheet 17 is prolonged at right angles to the thickness direction (the vertical direction in drawing 1) of sheet-like base material 17b, the both ends of each of that conductive extra fine wire are exposed, respectively from the front face and the rear face of sheet-like base material 17b. And with this operation gestalt, two or more conductivity extra-fine-wire 17a projected from the rear face of the anisotropy electric conduction sheet 17 in this probe pin 11 location is made flange top-face 11b' of each probe pin 11 soldering 12, and this probe pin 11 and said two or more conductivity extra-fine-wire 17a of the location corresponding to this are electrically connected to it. And the probe pin support plate 13 with which the probe pin 11 was inserted is screwed on the lower limit of the support-saddle section 21 by **** 18. In addition, contact section 11a which disc-like flange 11b is formed in a head, and has sharpened the configuration of the probe pin 11 at the tip is formed.

[0016] About soldering of this probe pin 11 and two or more conductivity extra-fine-wire 17a in every probe pin 11 The probe pin 11 which welded [flange top-face 11b] solder beforehand After inserting and stopping from the upper part to through tube 13a drilled in the probe pin support plate 13, Lay the anisotropy electric conduction sheet 17 on the probe pin 11, and the upward force is applied from contact section 11a of the probe pin 11. By contacting the conductive extra-fine-wire 17a edge exposed to flange top-face 11b' which solder welds from the rear face of the anisotropy electric conduction sheet 17 (it has projected), and heating the probe pin 11 from a lower part in this condition Or by energizing between the probe pin 11 and said conductive extra-fine-wire 17a, and melting solder, flange top-face 11b' of the probe pin 11 and said conductive extra-fine-wire 17a are carried out soldering 12.

[0017] When exchanging the probe pin 11 which was damaged and became measurement impossible, the anisotropy electric conduction sheet 17 and each probe pin 11 can be separated by heating each probe pin 11 from a lower part, and melting a solder part. Then, the probe pin which became measurement impossible is exchanged to a new thing. Therefore, in the probe card 10 incorporating the anisotropy electric conduction sheet 17, since the damaged probe pins or all the probe pins can be exchanged and it can reproduce, the cast away of probe card 10 the very thing haves to be carried out.

[0018] this invention -- starting -- an anisotropy -- electric conduction -- a sheet -- 17 -- mentioning later -- as -- for example, -- a diameter -- 20 -- micrometer -- conductivity -- an extra fine wire -- 17 -- a -- 40 -- micrometer -- a pitch -- having arranged -- although -- a case -- drawing 4 -- being shown -- as -- a probe -- a pin -- 11 -- a diameter -- about -- 80 -- micrometer -- a flange -- a top face -- 11 -- b -- ' -- **** -- always -- a sound condition -- several -- a ** -- conductivity -- an extra fine wire -- 17 -- a -- contacting -- ******** . Therefore, this anisotropy electric conduction sheet 17 can be used, without being influenced by the array of the probe pin 11.

[0019] And the anisotropy electric conduction sheet 17 concerning this invention can be used by doubling with the location of each probe pin 11 corresponding to these the location of each electrode pad 16a by the side of the inferior surface of tongue of the tooth-space spreading device (tooth-space transformer) 16 used in piles on the anisotropy electric conduction sheet 17, and doubling the diameter dimension of electrode pad 16a with the diameter of flange 11b of the probe pin 11.
[0020] About the assembly of a probe card 10, as mentioned above, the conductive extra-fine-wire 17a edge exposed to flange top-face 11b' of the probe pin 11 from the inferior surface of tongue of the anisotropy electric conduction sheet 17 is soldered, each probe pin 11 is fixed on the anisotropy electric conduction sheet 17, the probe pin support plate 13 in which each of this probe pin 11 was inserted is ****ed, and it screws on support-saddle section 21 lower limit by 18. And said support-saddle section 21 is fixed [the tooth-space spreading device 16 supported in the support-saddle section 21] for superposition and each inferior-surface-of-tongue lateral electrode pad 15of the circuit board 15 corresponding to [subsequently to a it top lay the circuit board 15, and] each top-face lateral electrode pad 16b [of the tooth-space spreading device 16], and these a with a male screw 19 and a female screw 20 superposition and after an appropriate time on the anisotropy electric conduction sheet 17 on the circuit board 15 inferior surface of tongue. thereby, it can set to each probe pin 11 and the circuit board 15 -- this -- each top-face lateral electrode pad 15b corresponding to each [these] probe pin 11 will be connected electrically.
[0021] In addition, as for the quality of the material of the probe pin 11, what has comparatively low electric resistance is good with metals which cannot oxidize easily below 200 degrees C, such as a palladium alloy, a beryllium copper alloy, an iridium alloy, nickel, a nickel alloy, and a rhodium alloy. Moreover, the quality of the material of the probe pin support plate 13 and the probe pin guide plate 14 is the ceramics. The quality of the material of screw threads 18, 19, and 20 is stainless steel, and the quality of the material of the support-saddle section 21 is stainless steel or the ceramics.
[0022] Thus, the probe pin 11 two or more (many) contacted so that it may become perpendicular [this probe card 10] to electrode pad 23a of LSI chip 23 which is a measuring object object, The circuit board 15 of one sheet in which the signal-line pattern connected with each of these probe pins 11 was formed, The pace spreading device 16 of one sheet with which it was allotted to this circuit board 15 bottom, and each electrode pad 16a which opposite arrangement is carried out right above, and is electrically connected to said circuit board 15 to each of said probe pin [two or more (many)] 11 was prepared in the field of the opposite side in this circuit board 15, It comes to have conductive super-thin track group 17a' in sheet-like base material 17b. It has the anisotropy electric conduction sheet 17 of one sheet which is arranged between said probe pins [two or more (many)] 11 and said pace spreading devices 16, and connects electrically each probe pin 11 and each electrode pad 16a of said pace spreading device 16, respectively, and is constituted.
[0023] Drawing 2 is a typical sectional view for explaining the procedure of the manufacture approach of the anisotropy electric conduction sheet by 1 operation gestalt of this invention.
[0024] The manufacture approach of the anisotropy electric conduction sheet concerning this invention produces said anisotropy electric conduction sheet 17 using a LIGA (Lithograph Galvanoformung und Abformung) process. As everyone knows, a LIGA process is the production approach of the molding of the fine structure, and is a process including the deep dirty X-ray-lithography process of irradiating an X-ray at the particular part on the resist film, removing an X-ray lithography part from the resist film, and obtaining the fine structure resist film of negative structure, and the electrocasting process which obtains fine structure metal molding with electroforming into said removal part of this fine structure resist film.
[0025] In this operation gestalt, first, as shown in (a) of drawing 2 , the resist film 25 of uniform thickness with a thickness of 200 micrometers is formed on the rectangular metal substrate 24 with a thickness 0.5x width-of-face 30x die length of 30mm. Copper was used for the ingredient of the metal substrate 24 from the point which is made not to be eaten away by a conductive point and the conductive below-mentioned electrocasting liquid (plating liquid).

Polymethylmethacrylate resin (PMMA resin) was used for the resist ingredient used for the resist film 25. On the metal substrate 24, this PMMA resin was applied, the resist film 25 was formed, and desiccation of 4 hours was performed in ordinary temperature after that.
[0026] As shown in (b) of drawing 2 , on the resist film 25 Next, diameter:10-250micrometer of conductive extra-fine-wire 17a, The mask 26 describing the projection configuration of conductive super-thin track group 17a' arranged within the limits of 30-500 micrometers The pitch between conductive extra-fine-wire 17a (spacing distance) : in piles An X-ray is irradiated from the perpendicular direction upper part of a mask 26, and an X-ray is made to expose the part which is not covered with the mask 26 of the resist film 25. In this example, the mask 26 describing the projection configuration of conductive super-thin track group 17a' arranged by diameter:20micrometer of conductive extra-fine-wire 17a and pitch:40micrometer of conductive extra-fine-wire 17a was used. A mask 26 is the Germany Karlsruhe [for example,] thing. As an X-ray used at this deep dirty X-ray-lithography process, while excelling in reinforcement and directivity, it is desirable to use a synchrotron radiation X-ray from the point that the configuration precision of the resist side-attachment-wall side of fine structure resist film 25' obtained is excellent. Subsequently, by carrying out dissolution removal of the X-ray lithography part of the resist film 25 by development the fine structure resist film 25 with which the configuration of conductive super-thin track group 17a' where the value of the aspect ratio (die length/diameter) (value) of each conductive extra-fine-wire 17a was 10 was formed as a dissolution removal part -- ' -- forming -- The conductive super-thin track group matrix 27 which comes to have fine structure resist film 25' is formed on the metal substrate 24 (refer to (c) of drawing 2).
[0027] next -- drawing 2 -- (-- d --) -- being shown -- as -- conductivity -- super-thin -- a track group -- a matrix -- 27 -- the fine structure -- a resist -- the film -- 25 -- ' -- said -- the dissolution -- removal -- a part -- electroforming -- each -- conductivity -- an extra fine wire -- 17 -- a -- a book -- an example -- **** -- nickel -- becoming -- conductivity -- super-thin -- a track group -- 17 -- a -- ' -- forming . In this electrocasting process, into the plating liquid 29 in a plating bath 28 (sulfamic acid bath), it was immersed, the conductive super-thin track group matrix 27 was used as the electrode by the side of plus of the nickel electrode 30, and electrocasting was performed as an electrode by the side of minus of the metal substrate 24. In this case, in order for plating liquid 29 to make it easy to invade into the dissolution removal part (conductive extra-fine-wire formation part) of fine structure resist film 25' and to form healthy conductive super-thin track group 17a', it is desirable to pressurize plating liquid 29 or to supply plating liquid 29 in the shape of a shower. In addition, conductive super-thin track group 17a' formed by electroforming has good things, such as a product made from nickel from a conductive point, copper, and a product made from a nickel cobalt alloy.
[0028] Dissolution removal of the resist film with which after a electrocasting process and the surroundings of said formed conductive super-thin track group 17a' remain is carried out, and that by which conductive super-thin track group 17a' was formed on the metal substrate 24 is obtained. Next, as this thing was held in shuttering 31 and it was shown in (f) of drawing 2 , by filling up silicone resin into the surroundings of conductive super-thin track group 17a' with this example as sheet-like base material ingredient (sheet-like base material material) 17b', and stiffening this, into sheet-like base material 17b made of silicone resin, it came to fix conductive super-thin track group 17a', and thing production was carried out on the metal substrate 4. With electric insulation, sheet-like base material 17b has the resiliency for easing contact pressure when the probe pin 11 contacts electrode pad 23a of LSI chip 23, and silicone resin, silicone rubber (silicone rubber), etc. can be used for it.
[0029] Next, the metal substrate 24 is removed from said produced thing, and the anisotropy electric conduction sheet before trimming processing (illustration abbreviation) is obtained. In addition, in the process of said drawing 2 (f), before being filled up with silicone resin, the remover for metal substrate separation is applied to the front face of the metal substrate 24. And as trimming processing of the front face and the rear face of sheet-like base material 17b of this obtained anisotropy electric conduction sheet before trimming processing is carried out with an excimer laser and it is shown in (g) of drawing 2 The anisotropy electric conduction sheet 17

which comes to have conductive super-thin track group 17a' arranged in said pitch in this sheet-like base material 17b in the condition that about 10 micrometers of each of both ends of each conductive extra-fine-wire 17a are exposed by this example from sheet-like base material 17b into sheet-like base material 17b was produced. Since an edge is exposed on the other hand in each conductive extra-fine-wire 17a from a sheet-like base material 17b inferior surface of tongue (rear face) and the another side edge is exposed from the sheet-like base material 17b top face (front face) With this anisotropy electric conduction sheet 17, soldering of the conductive extra-fine-wire 17a edge and flange top-face 11b' of the probe pin 11 which have been exposed from the sheet-like base material 17b inferior surface of tongue can be ensured. Moreover, contact to the conductive extra-fine-wire 17a edge and inferior-surface-of-tongue lateral electrode pad 16a of the tooth-space spreading device 16 which have been exposed from the sheet-like base material 17b top face is made certainly. In addition, in order that the edge which has exposed each conductive extra-fine-wire 17a may be ground and sharpened and may lower electric resistance, it may be made to gold-plate if needed at this edge.

[0030] Thus, the anisotropy electric conduction sheet 17 is producible using a LIGA process. In addition, since the sensitization thickness of the resist film 25 by 1 time of X-ray irradiation is about 200 micrometers, here If it is going to obtain the anisotropy electric conduction sheet [that the die length of each conductive extra-fine-wire 17a is longer than 200 micrometers (that is, ten or more are the aspect ratio when a diameter is 10-20 micrometers)] 17 Although conductive super-thin track group 17a' obtained by (d) of drawing 2 was formed, upwards, the resist film 25 is formed again. And an X-ray is irradiated on a mask 26 from the upper part of this mask 26 in piles on this resist film 25, and what formed fine structure resist film 25' further upwards although conductive super-thin track group 17a' obtained by (d) of drawing 2 was formed can be produced by carrying out dissolution removal of the X-ray lithography part of this resist film 25 by development. And by carrying out in order the electrocasting process mentioned above and a trimming process henceforth, the die length of each conductive extra-fine-wire 17a can produce the anisotropy electric conduction sheet 17 which has conductive super-thin track group 17a' which is about 400 micrometers.

[0031] Drawing 3 is a typical sectional view for explaining other production approaches of the conductive super-thin track group matrix in the manufacture approach of the anisotropy electric conduction sheet concerning this invention. Comparatively high costs start formation of fine structure resist film 25' by X-ray irradiation. Then, it is possible to produce the conductive super-thin track group matrix of the 2nd henceforth, using that by which conductive super-thin track group 17a' was formed on the metal substrate 24 obtained in (e) of said drawing 2 as a male mold. As shown in drawing 3 , on one side of the metal substrate 24 namely, after forming the film 32 for conductive super-thin track group formation which consists of PMMA resin, applying heat to this and this film 32 for formation having become soft, [for example,] drawing 3 -- (-- a --) -- being shown -- as -- said -- a male -- a mold -- pushing -- things -- drawing 3 -- (-- b --) -- being shown -- as -- a metal -- a substrate -- 24 -- a top -- the fine structure -- the film -- 32 -- ' -- having -- becoming -- conductivity -- super-thin -- a track group -- a matrix -- 27 -- ' -- being producible .

[0032] In the anisotropy electric conduction sheet concerning this invention Diameter:10-250micrometer of a conductive extra fine wire, Since it has the conductive super-thin track group arranged by within the limits with a pitch [between conductive extra fine wires] of d:30-500 micrometers, as shown in drawing 4 , in the example of the book which arranged each conductivity with a diameter of 20 micrometers extra-fine-wire 17a in the pitch of d= 40 micrometers, for example Flange top-face 11b' (diameter of 80 micrometers) of the probe pin 11 will always contact several conductivity extra-fine-wire 17a by the sound condition. Incidentally, 10000 or more conductive extra-fine-wire 17a will be arranged by the anisotropy electric conduction sheet 17 of 5mm angle.

[0033] In addition, although conductive extra-fine-wire 17a is arranged in the anisotropy electric conduction sheet 17 by said operation gestalt so that it may extend perpendicularly along the thickness direction of sheet-like base material 17b In order to ease the force of joining conductive extra-fine-wire 17a at the time of an overdrive on the occasion of contact to the

probe pin 11 and electrode pad 23a of LSI chip 23 irradiating an X-ray from the slanting upper part at the resist film 25 at the time of anisotropy electric conduction sheet 17 manufacture -- the shape of a sheet -- conductive extra-fine-wire 17a is made to incline to base material 17b page, and you may make it arrange Whenever [tilt-angle / at this time] receives perpendicularly, and its less than 60 degrees are desirable. moreover, the phase shown in (e) of drawing 2 in order to lower the electric resistance of this conductive super-thin bar-chart side, since a current will flow the front face of conductive extra-fine-wire 17a, if the RF signal current is used for measurement of many electric properties of LSI chip 23 -- the front face of each conductive extra-fine-wire 17a -- gold -- or it may be made to carry out silver plating.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the typical sectional view showing the configuration of flow BUKADO by 1 operation gestalt of this invention.
[Drawing 2] It is a typical sectional view for explaining the procedure of the manufacture approach of the anisotropy electric conduction sheet by 1 operation gestalt of this invention.
[Drawing 3] It is a typical sectional view for explaining other production approaches of the conductive super-thin track group matrix in the manufacture approach of the anisotropy electric conduction sheet concerning this invention.
[Drawing 4] It is the top view showing an example of the physical relationship of the conductive extra fine wire of an anisotropy electric conduction sheet and the flange top face of a probe pin concerning this invention.
[Drawing 5] It is the typical sectional view showing the configuration of the probe card of the conventional vertical type.
[Description of Notations]
10 -- probe card 11 -- probe pin the 11a-- contact section 11b-- flange 11b'-- flange top face 12 -- soldering 13 -- probe pin support plate 13a-- through tube 14 -- probe pin guide plate 14a-- through tube 15 -- circuit board 15a-- inferior-surface-of-tongue lateral electrode pad 15b-- top-face lateral electrode pad 16 -- tooth-space spreading device 16a-- inferior-surface-of-tongue lateral electrode pad 16b-- top-face lateral electrode pad 17 -- anisotropy electric conduction sheet 17a-- conductivity super-thin track group 17a'-- conductivity super-thin track group 17b-- sheet-like base material 17b'-- sheet-like base material ingredient 18 -- ****ing -- 19 -- male screw 20 -- female screw 21 -- support-saddle section 22 -- wafer installation base 23 -- LSI chip 23a-- electrode pad 24 -- metal substrate 25 -- resist film 25'-- fine structure resist film [ ] -- 26 -- mask 27 and 27' -- conductivity super-thin track group matrix 28 -- plating-bath 29 -- plating liquid 30 -- Nickel electrode 31 -- Shuttering 32 -- Film for conductive super-thin track group formation 32' -- Fine structure film

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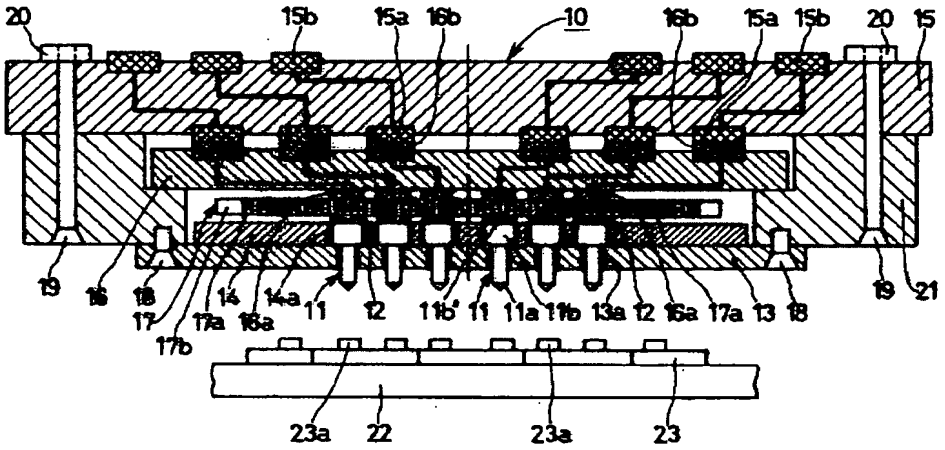
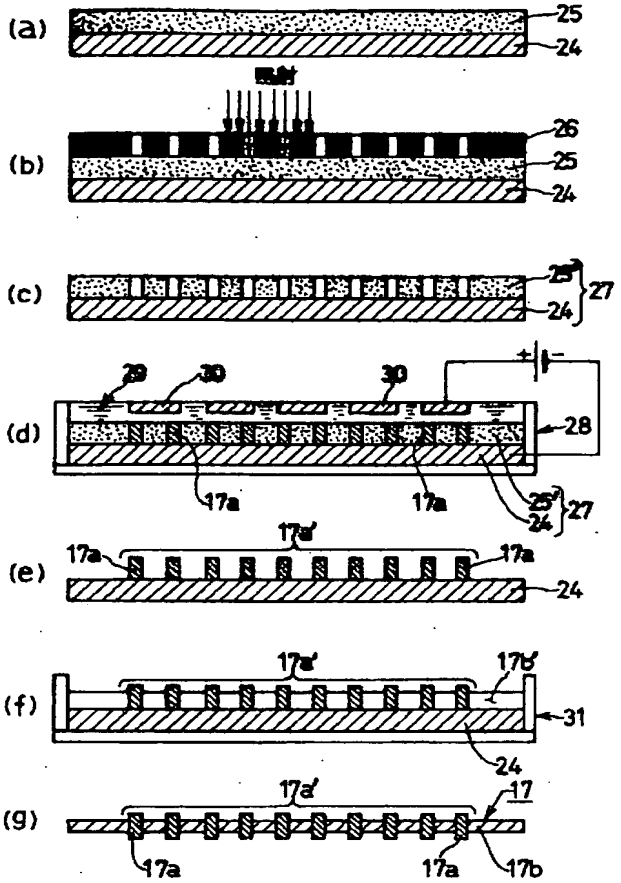
DRAWINGS

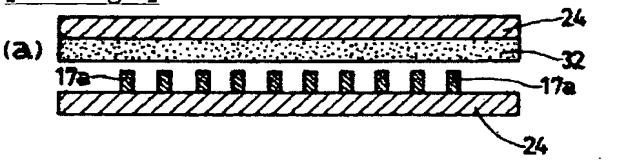
[Drawing 1]



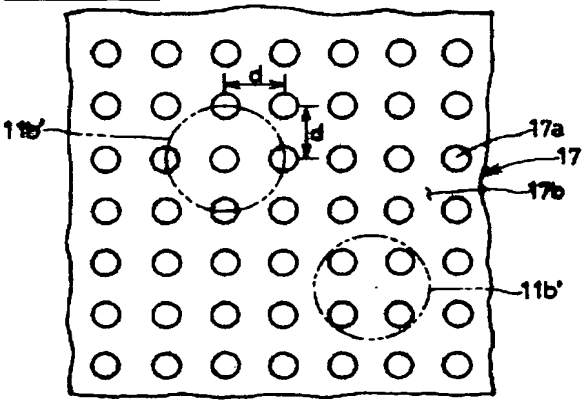
[Drawing 2]



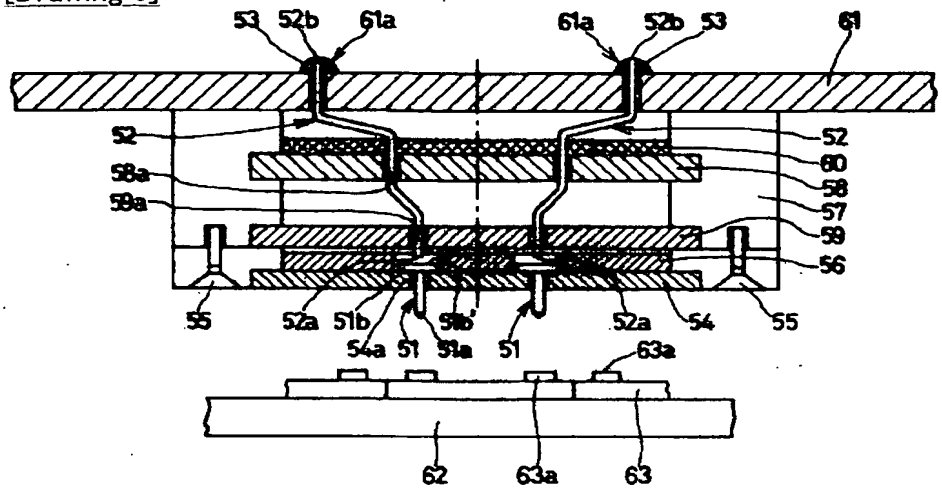
[Drawing 3]



[Drawing 4]



[Drawing 5]



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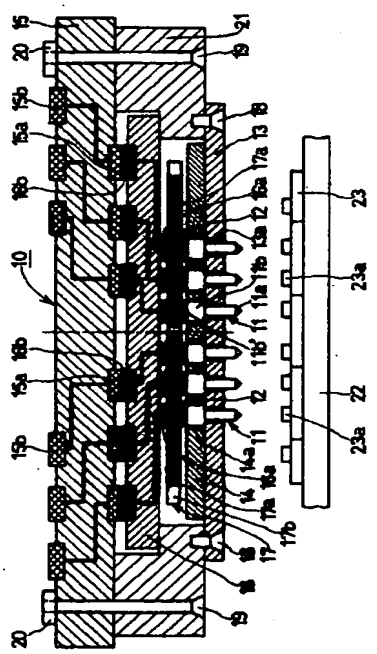
(54)【発明の名称】　プローブカード及びそれに用いられる異方性導電シートの製造方法

(57)【要約】
【課題】　半導体集積回路の微細化に対応することができる、プローブカード及びそれに用いられる異方性導電シートの製造方法を提供すること。
【解決手段】　測定対象物の電極パッド２３ａに接触させる複数個のプローブピン１１と、前記各プローブピン１１と接続される信号線パターンが形成された回路基板１５と、回路基板１５の下側に配され、回路基板１５とは反対側の面に前記複数個のプローブピン１１の各々に対して対向配置され且つ回路基板１５に電気的に接続される各電極パッド１６ａが設けられたベーススプレッダー１６と、シート状基材１７ｂ中に導電性極細線群１７ａ'を配してなり、前記複数個のプローブピン１１とベーススプレッダー１６との間に配置されて各プローブピン１１とベーススプレッダー１６の各電極パッド１６ａとをそれぞれ電気的に接続する異方性導電シート１７とを備えていることを特徴とするプローブカード。



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【特許請求の範囲】

【請求項１】　測定対象物の電気的諸特性を測定するためのプローブカードにおいて、測定対象物の電極パッドに接触させる複数個のプローブピンと、前記各プローブピンと接続される信号線パターンが形成された回路基板と、前記回路基板の下側に配され、該回路基板とは反対側の面に前記複数個のプローブピンの各々に対して対向配置され且つ前記回路基板に電気的に接続される各電極パッドが設けられたベーススプレッダーと、シート状基材中に導電性極細線群を配してなり、前記複数個のプローブピンと前記ベーススプレッダーとの間に配置されて各プローブピンと前記ベーススプレッダーの各電極パッドとをそれぞれ電気的に接続する異方性導電シートとを備えていることを特徴とするプローブカード。

【請求項２】　（イ）金属基板上に、レジスト膜と、導電性極細線の直径：１０～２５０μｍ、導電性極細線間のピッチ：３０～５００μｍの範囲内で配列された導電性極細線群の投影形状を描いたマスクとを順に重ねる工程と、（ロ）前記マスクの上方よりＸ線を照射し、前記レジスト膜の前記マスクによって遮蔽されていない部分をＸ線に露光させ、レジスト膜の該Ｘ線露光部分を現像により溶解除去することにより、導電性極細線群の形状が溶解除去部分として形成された微細構造レジスト膜を形成して、前記金属基板上に該微細構造レジスト膜を有する導電性極細線群母型を形成する工程と、（ハ）前記導電性極細線群母型の微細構造レジスト膜の前記溶解除去部分に、電鋳法により導電性極細線群を形成する工程と、（ニ）形成された導電性極細線群の周りのレジスト膜を除去し、該導電性極細線群の周りにシート状基材材料を充填することで電気絶縁性と弾力性を有するシート状基材中に導電性極細線群を固定し、次にこのものから前記金属基板を取り外してトリミング処理前異方性導電シートを得る工程と、（ホ）得られた該トリミング処理前異方性導電シートのシート状基材の表面・裏面をトリミング処理して、シート状基材中に個々の導電性極細線の両端部がシート状基材より露出する状態にて該シート状基材中に前記範囲内にて配列された導電性極細線群を配してなる異方性導電シートを作製する工程とを含むことを特徴とする異方性導電シートの製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、測定対象物であるＬＳＩチップ等の電気的諸特性の測定に用いられる垂直型のプローブカードとそれに用いられる異方性導電シートの製造方法に関するものである。

【０００２】

【従来の技術】ＬＳＩチップ等の電気的諸特性の測定に用いられる従来の垂直型のプローブカードは、図５に示すように、ＬＳＩチップ６３を載置したウエハー載置台６２の上昇によってプローブピン５１の接触部（先端

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部）５１ａがＬＳＩチップ６３の電極パッド６３ａに接触し、次いでプローブピン５１の頭部（後端部）に形成されたフランジ５１ｂの上面５１ｂ’が、導線５２の先端の接触部５２ａと接触する。そしてオーバードライブを加えることで電極パッド６３ａに所定の接触圧を与えることができ、この状態でＬＳＩチップ６３の電気的諸特性を測定する。

【０００３】プローブピン５１は、プローブピン支持板５４に穿設された貫通孔５４ａに上方から挿入され、プローブピン５１の頭部に貫通孔５４ａの径より大きく形成されたフランジ５１ｂによってプローブピン支持板５４に係止されている。そしてプローブピン５１が挿入されたプローブピン支持板５４は、ねじ５５によって回路基板６１から垂下された支持脚部５７の下端に固定されている。５６はプローブピンガイド板である。プローブピン５１の形状は、頭部に円盤状のフランジ１５１ｂが形成され、先端には尖らしてある接触部５１ａが形成され、寸法は例えば、フランジ径：８０μｍ、プローブピン径：４０～５０μｍ、長さ：１０００～２０００μｍである。

【０００４】測定時、プローブピン５１のフランジ上面５１ｂ’に先端の接触部５２ａが接触する導線５２は、上支持板５８及び下支持板５９に穿設されている貫通孔５８ａ，５９ａに通され、上支持板５８の上面に固定材６０で固定されている。上支持板５８に固定されている導線５２の接続部５２ｂが回路基板６１の接続部６１ａにはんだ付け５３されている。このように、導線５２を上支持板５８上面に固定材６０で固定することによって、オーバードライブが加えられたとき、導線５２に作用する上向きの力で接続部６１ａのはんだ付け５３が剥がれるのを防止している。

【０００５】このように、従来の垂直型のプローブカードは、プローブピン５１を挿入、係止したプローブピン支持板５４をねじ５５で支持脚部５７の下端に着脱可能に螺着する機構であるため、プローブピン５１の損傷によって測定不能になった場合でも、ねじ５５を弛めてプローブピン支持板５４を支持脚部５７から外すことによって、損傷したプローブピン５１のみ、あるいはプローブピン５１の全てを取り換えて再生することができるため、プローブカードを廃却することはない。前記、従来の垂直型プローブカードは、本出願人によって特願２０００－２３１２８号に提案されている。

【０００６】

【発明が解決しようとする課題】ところが、前記のプローブカードでは、プローブカードを組み立てるに際して、上支持板５８及び下支持板５９に穿設されている貫通孔５８ａ，５９ａに、導線５２を通す工程が必要になる。この工程は、導線である線径５０～１００μｍのタングステン線を貫通孔５８ａ，５９ａに１５００～５０００本程度通すという手間のかかる作業であった。

【０００７】プローブカードの組み立て時の、前記工程を省略するために、上支持板５８に代えてスペーススプレッダー（スペーストランスホーマー）を用い、下支持板５９に代えて、電気絶縁性を有するシート状の基材中に導電性細線を配列した構造の異方性導電シート（インターポーザー）を用いるようにしたプローブカードが知られている。しかし、従来の異方性導電シートは、各プローブピンに対してその真上位置にプローブピン１本に対し１本の対応関係にて導電性細線を配列してなるものであり、プローブピンの配列が異なるとその配列に対応して導電性細線を配列した新たな異方性導電シートが必要になる。すなわち、従来の異方性導電シートは特定のプローブピンの配列に対応したものであり、一枚の異方性導電シートで異なったプローブピンの配列に対応できるものではなかった。

【０００８】そして、現在、ＬＳＩチップの電極（電極パッド）のピッチ寸法は８０μｍを下回るようになってきており、半導体集積回路の微細化の進展に対応しうるプローブカードが要請されており、そのために異方性導電シートとして直径１０μｍの導電性の線を３０μｍピッチにて配列可能なものが求められている。

【０００９】本発明は、このような事情に鑑みてなされたものであって、半導体集積回路の微細化に対応することができる、プローブカード及びそれに用いられる異方性導電シートの製造方法を提供することを目的とするものである。

【００１０】

【課題を解決するための手段】前記の目的を達成するために、請求項１の発明は、測定対象物の電気的諸特性を測定するためのプローブカードにおいて、測定対象物の電極パッドに接触させる複数個のプローブピンと、前記各プローブピンと接続される信号線パターンが形成された回路基板と、前記回路基板の下側に配され、該回路基板とは反対側の面に前記複数個のプローブピンの各々に対して対向配置され且つ前記回路基板に電気的に接続される各電極パッドが設けられたベーススプレッダーと、シート状基材中に導電性極細線群を配してなり、前記複数個のプローブピンと前記ベーススプレッダーとの間に配置されて各プローブピンと前記ベーススプレッダーの各電極パッドとをそれぞれ電気的に接続する異方性導電シートとを備えていることを特徴とするプローブカードである。

【００１１】請求項２の発明は、（イ）金属基板上に、レジスト膜と、導電性極細線の直径：１０～２５０μｍ、導電性極細線間のピッチ：３０～５００μｍの範囲内で配列された導電性極細線群の投影形状を描いたマスクとを順に重ねる工程と、（ロ）前記マスクの上方よりＸ線を照射し、前記レジスト膜の前記マスクによって遮蔽されていない部分をＸ線に露光させ、レジスト膜の該Ｘ線露光部分を現像により溶解除去することにより、導電性極細線群の形状が溶解除去部分として形成された微細構造レジスト膜を形成して、前記金属基板上に該微細構造レジスト膜を有する導電性極細線群母型を形成する工程と、（ハ）前記導電性極細線群母型の微細構造レジスト膜の前記溶解除去部分に、電鋳法により導電性極細線群を形成する工程と、（ニ）形成された導電性極細線群の周りのレジスト膜を除去し、該導電性極細線群の周りにシート状基材材料を充填することで電気絶縁性と弾力性を有するシート状基材中に導電性極細線群を固定し、次にこのものから前記金属基板を取り外してトリミング処理前異方性導電シートを得る工程と、（ホ）得られた該トリミング処理前異方性導電シートのシート状基材の表面・裏面をトリミング処理して、シート状基材中に個々の導電性極細線の両端部がシート状基材より露出する状態にて該シート状基材中に前記範囲内にて配列された導電性極細線群を配してなる異方性導電シートを作製する工程とを含むことを特徴とする異方性導電シートの製造方法である。

【００１２】

【発明の実施の形態】図１は本発明の一実施形態によるプローブカードの構成を示す模式的断面図である。

【００１３】図１に示すように、この実施の形態による垂直型のプローブカード１０は、測定対象物であるＬＳＩチップ２３の電気的諸特性を測定するためのものであって、ＬＳＩチップ２３を載置したウエハー載置台２２の上昇によってプローブピン１１の接触部１１ａがＬＳＩチップ２３の電極パッド２３ａに接触し、オーバードライブを加えることで電極パッド２３ａに所定の接触圧を与えることができ、この状態でＬＳＩチップ２３の電気的諸特性を測定する。

【００１４】プローブピン１１は、プローブピン支持板１３に穿設された貫通孔１３ａに上方から垂直に挿入され、プローブピン１１の頭部に前記貫通孔１３ａの径より大きく形成されたフランジ１１ｂによってプローブピン支持板１３に係止される。プローブピン１１が挿入される前記貫通孔１３ａは測定すべきＬＳＩチップ２３の電極パッド２３ａの位置に一致させて、プローブピン支持板１３の面に対して垂直に穿設されている。また、図１に示すように、プローブピン支持板１３上面には、プローブピン１１のフランジ１１ｂが嵌められる貫通孔１４ａが穿設されたプローブピンガイド板１４が設けてある。これにより、プローブピン１１はＬＳＩチップ２３の電極パッド２３ａに対して垂直となるように接触し、かつプローブピンガイド板１４によってプローブピン１１の位置を安定させる。

【００１５】１７は異方性導電シートであり、電気絶縁性と弾力性とを有する方形のシート状基材１７ｂ中に導電性極細線群１７ａ’を配した構造のものである。この異方性導電シート１７の導電性極細線群１７ａ’を構成する個々の導電性極細線１７ａは、シート状基材１７ｂ

の厚み方向（図１における上下方向）に垂直に延びるとともに、その各導電性極細線の両端がシート状基材１７ｂの表面・裏面よりそれぞれ露出されている。そして、この実施形態では、各プローブピン１１のフランジ上面１１ｂ’には、該プローブピン１１位置において異方性導電シート１７の裏面から突出している複数本の導電性極細線１７ａがはんだ付け１２され、該プローブピン１１とこれに対応する位置の前記複数本の導電性極細線１７ａとが電気的に接続されている。そして、プローブピン１１が挿入されたプローブピン支持板１３は、ねじ１８によって支持脚部２１の下端に螺着されている。なお、プローブピン１１の形状は、頭部に円盤状のフランジ１１ｂが形成され、先端には尖らしてある接触部１１ａが形成されている。

【００１６】各プローブピン１１ごとにおける該プローブピン１１と複数本の導電性極細線１７ａとのはんだ付けについては、予めフランジ上面１１ｂ’にはんだを溶着したプローブピン１１を、プローブピン支持板１３に穿設した貫通孔１３ａに上方から挿入して係止した後、プローブピン１１の上に異方性導電シート１７を載置し、プローブピン１１の接触部１１ａから上向きの力を加え、はんだが溶着しているフランジ上面１１ｂ’に、異方性導電シート１７の裏面より露出している（突出している）導電性極細線１７ａ端部を接触させ、この状態でプローブピン１１を下方から加熱することにより、あるいはプローブピン１１と前記導電性極細線１７ａ間に通電してはんだを溶かすことにより、プローブピン１１のフランジ上面１１ｂ’と前記導電性極細線１７ａとがはんだ付け１２される。

【００１７】損傷して測定不能になったプローブピン１１を取り換える場合は、各プローブピン１１を下方から加熱してはんだ部分を溶かすことにより、異方性導電シート１７と各プローブピン１１とを分離することができる。その後、測定不能になったプローブピンを新しいものに取り換える。よって、異方性導電シート１７を組み込んだプローブカード１０では、損傷したプローブピンのみ、あるいはプローブピンの全てを取り換えて再生することができるため、プローブカード１０自体を廃却しなくてすむことになる。

【００１８】本発明に係る異方性導電シート１７は、後述するように、例えば、直径２０μｍの導電性極細線１７ａを４０μｍピッチで配列したものの場合、図４に示すように、プローブピン１１の直径約８０μｍのフランジ上面１１ｂ’には、常に完全な状態で数本の導電性極細線１７ａが接触することになる。したがって、プローブピン１１の配列に左右されることなく、この異方性導電シート１７を使用することができる。

【００１９】そして、異方性導電シート１７の上に重ねて使用するスペーススプレッダー（スペーストランスフォーマー）１６の下面側の各電極パッド１６ａの位置を、これらに対応する各プローブピン１１の位置に合わせ、また、電極パッド１６ａの直径寸法をプローブピン１１のフランジ１１ｂ径に合わせておくことで、本発明に係る異方性導電シート１７を使用することができる。

【００２０】プローブカード１０の組み立てについては、前述したように、プローブピン１１のフランジ上面１１ｂ’に異方性導電シート１７の下面より露出している導電性極細線１７ａ端部をはんだ付けして、異方性導電シート１７に各プローブピン１１を固着し、この各プローブピン１１が嵌められたプローブピン支持板１３をねじ１８によって支持脚部２１下端に螺着する。そして、支持脚部２１で支持されるスペーススプレッダー１６を異方性導電シート１７上に重ね合わせ、次いでその上に回路基板１５を載置して、スペーススプレッダー１６の各上面側電極パッド１６ｂとこれらに対応する回路基板１５の各下面側電極パッド１５ａとを重ね合わせ、しかる後、おねじ１９及びめねじ２０により回路基板１５下面に前記支持脚部２１を固定する。これにより、各プローブピン１１と、回路基板１５における該これら各プローブピン１１に対応する各上面側電極パッド１５ｂとが電気的に接続されることになる。

【００２１】なお、プローブピン１１の材質は、パラジウム合金、ベリリウム銅合金、イリジウム合金、ニッケル、ニッケル合金、ロジウム合金など、２００℃以下で酸化しにくい金属で電気抵抗が比較的低いものがよい。また、プローブピン支持板１３及びプローブピンガイド板１４の材質はセラミックスである。ねじ１８，１９，２０の材質はステンレス鋼で、支持脚部２１の材質はステンレス鋼あるいはセラミックスである。

【００２２】このように、このプローブカード１０は、測定対象物であるＬＳＩチップ２３の電極パッド２３ａに垂直となるように接触させる複数個（多数個）のプローブピン１１と、これらの各プローブピン１１と接続される信号線パターンが形成された１枚の回路基板１５と、この回路基板１５の下側に配され、該回路基板１５とは反対側の面に前記複数個（多数個）のプローブピン１１の各々に対して真上に対向配置され且つ前記回路基板１５に電気的に接続される各電極パッド１６ａが設けられた１枚のベーススプレッダー１６と、シート状基材１７ｂ中に導電性極細線群１７ａ’を有してなり、前記複数個（多数個）のプローブピン１１と前記ベーススプレッダー１６との間に配置されて各プローブピン１１と前記ベーススプレッダー１６の各電極パッド１６ａとをそれぞれ電気的に接続する１枚の異方性導電シート１７とを備えて構成されている。

【００２３】図２は本発明の一実施形態による異方性導電シートの製造方法の手順を説明するための模式的断面図である。

【００２４】本発明に係る異方性導電シートの製造方法は、ＬＩＧＡ（Lithograph Galvanoformung und Abf

ormung）プロセスを用いて前記異方性導電シート１７を作製するようにしたものである。周知のように、ＬＩＧＡプロセスは、微細構造の成型物の作製方法であって、レジスト膜上の特定部分にＸ線を照射し、レジスト膜からＸ線露光部分を除去して、ネガ構造の微細構造レジスト膜を得るディープエッチＸ線リソグラフィ工程と、この微細構造レジスト膜の前記除去部分に電鋳法により微細構造金属成型物を得る電鋳工程を含むプロセスである。

【００２５】本実施形態においては、まず、図２の（ａ）に示すように、例えば厚み０．５×幅３０×長さ３０ｍｍの方形の金属基板２４上に厚み２００μｍの均一な厚みのレジスト膜２５を形成する。金属基板２４の材料は、導電性の点、また後述の電鋳液（メッキ液）に侵食されないようにする点から銅を用いた。レジスト膜２５に用いるレジスト材料は、ポリメチルメタアクリレート樹脂（ＰＭＭＡ樹脂）を用いた。金属基板２４上にこのＰＭＭＡ樹脂を塗布してレジスト膜２５を形成し、その後、常温で４時間の乾燥を行った。

【００２６】次に、図２の（ｂ）に示すように、レジスト膜２５上に、導電性極細線１７ａの直径：１０～２５０μｍ、導電性極細線１７ａ間のピッチ（間隔距離）：３０～５００μｍの範囲内で配列された導電性極細線群１７ａ’の投影形状を描いたマスク２６を重ねて、マスク２６の垂直方向上方よりＸ線を照射し、レジスト膜２５のマスク２６によって遮蔽されていない部分をＸ線に露光させる。本例では、導電性極細線１７ａの直径：２０μｍ、導電性極細線１７ａ同士のピッチ：４０μｍで配列された導電性極細線群１７ａ’の投影形状を描いたマスク２６を用いた。マスク２６は、例えば、ドイツ国カールスルーエ社製のものである。このディープエッチＸ線リソグラフィ工程で用いられるＸ線としては、強度と指向性に優れるとともに、得られる微細構造レジスト膜２５’のレジスト側壁面の形状精度が優れている点から、シンクロトロン放射Ｘ線を用いることが好ましい。次いで、レジスト膜２５のＸ線露光部分を現像により溶解除去することにより、各導電性極細線１７ａのアスペクト比（（長さ／直径）の値）の値が１０である導電性極細線群１７ａ’の形状が溶解除去部分として形成された微細構造レジスト膜２５’を形成して、金属基板２４上に微細構造レジスト膜２５’を有してなる導電性極細線群母型２７を形成する（図２の（ｃ）参照）。

【００２７】次に、図２の（ｄ）に示すように、導電性極細線群母型２７の微細構造レジスト膜２５’の前記溶解除去部分に、電鋳法により、個々の導電性極細線１７ａが本例ではニッケルよりなる導電性極細線群１７ａ’を形成する。この電鋳工程においては、メッキ槽２８内のメッキ液（スルファミン酸浴）２９中に導電性極細線群母型２７を浸漬し、ニッケル電極３０をプラス側の電極とし、金属基板２４をマイナス側の電極として電鋳を行った。この場合、微細構造レジスト膜２５’の溶解除去部分（導電性極細線形成部分）にメッキ液２９が侵入しやすくして健全な導電性極細線群１７ａ’を形成するために、メッキ液２９を加圧したり、あるいは、シャワー状にメッキ液２９を供給したりすることが好ましい。なお、電鋳法によって形成される導電性極細線群１７ａ’は、導電性の点から、ニッケル製、銅製、ニッケル・コバルト合金製などのものがよい。

【００２８】電鋳工程後、前記形成された導電性極細線群１７ａ’の周りの残存しているレジスト膜を溶解除去して、金属基板２４上に導電性極細線群１７ａ’が形成されたものを得る。次に、このものを型枠３１内に収容し、図２の（ｆ）に示すように、導電性極細線群１７ａ’の周りにシート状基材材料（シート状基材素材）１７ｂ’として本例ではシリコーン樹脂を充填し、これを硬化させることにより、金属基板４上に、シリコーン樹脂製のシート状基材１７ｂ中に導電性極細線群１７ａ’を固定してなるもの作製した。シート状基材１７ｂは、電気絶縁性とともに、ＬＳＩチップ２３の電極パッド２３ａにプローブピン１１が接触したときの接触圧を緩和するための弾力性を有するものであり、シリコーン樹脂、シリコンゴム（シリコーンゴム）などを用いることができる。

【００２９】次に、前記作製したものから金属基板２４を取り外して、トリミング処理前異方性導電シート（図示省略）を得る。なお、前記図２（ｆ）の工程において、シリコーン樹脂を充填する前に、金属基板２４の表面に金属基板分離用の剥離剤を塗布してある。そして、この得られたトリミング処理前異方性導電シートのシート状基材１７ｂの表面・裏面をエキシマレーザーにてトリミング処理し、図２の（ｇ）に示すように、シート状基材１７ｂ中に個々の導電性極細線１７ａの両端部それぞれがシート状基材１７ｂより本例では１０μｍ程度露出する状態にて該シート状基材１７ｂ中に前記ピッチにて配列された導電性極細線群１７ａ’を有してなる異方性導電シート１７を作製した。各導電性極細線１７ａにおいて一方端をシート状基材１７ｂ下面（裏面）より露出させ、他方端をシート状基材１７ｂ上面（表面）より露出させているので、この異方性導電シート１７では、シート状基材１７ｂ下面より露出している導電性極細線１７ａ端部とプローブピン１１のフランジ上面１１ｂ’とのはんだ付けが確実に行え、また、シート状基材１７ｂ上面より露出している導電性極細線１７ａ端部とスペーススブレッダー１６の下面側電極パッド１６ａとの接触が確実になされる。なお、各導電性極細線１７ａの露出している端部は研磨して尖らせてあり、また、電気抵抗を下げるため該端部に必要に応じて金メッキを施すようにしてもよい。

【００３０】このようにして、ＬＩＧＡプロセスを用いて異方性導電シート１７を作製することができる。なお

ここで、１回のＸ線照射によるレジスト膜２５の感光厚さは２００μｍ程度であるので、各導電性極細線１７ａの長さが２００μｍよりも長い（つまり、直径が１０～２０μｍの場合はアスペクト比が１０以上になる）の異方性導電シート１７を得ようとすれば、図２の（ｄ）にて得られる導電性極細線群１７ａ’が形成されたものの上に、再度レジスト膜２５を形成する。そして、このレジスト膜２５の上にマスク２６を重ねて該マスク２６の上方よりＸ線を照射し、該レジスト膜２５のＸ線露光部分を現像により溶解除去することにより、図２の（ｄ）にて得られる導電性極細線群１７ａ’が形成されたものの上にさらに微細構造レジスト膜２５’を形成したものを、作製することができる。そして以降は前述した電鋳工程とトリミング工程を順に実施することで、個々の導電性極細線１７ａの長さが約４００μｍの導電性極細線群１７ａ’を有する異方性導電シート１７を作製することができる。

【００３１】図３は本発明に係る異方性導電シートの製造方法における導電性極細線群母型の他の作製方法を説明するための模式的断面図である。Ｘ線照射による微細構造レジスト膜２５’の形成には比較的高い費用がかかる。そこで、前記図２の（ｅ）において得られたところの、金属基板２４上に導電性極細線群１７ａ’が形成されたものを、おす型として用いて第２番目以降の導電性極細線群母型を作製することが可能である。すなわち、図３に示すように、金属基板２４の片面に例えばＰＭＭＡ樹脂よりなる導電性極細線群形成用膜３２を形成し、これに熱を加えて該形成用膜３２が軟化した状態で、図３（ａ）に示すように前記おす型に押し付けることにより、図３（ｂ）に示すように、金属基板２４上に微細構造膜３２’を有してなる導電性極細線群母型２７’を作製することができる。

【００３２】本発明に係る異方性導電シートにおいては、導電性極細線の直径：１０～２５０μｍ、導電性極細線間のピッチｄ：３０～５００μｍの範囲内で配列された導電性極細線群を持つものであるから、例えば、直径２０μｍの各導電性極細線１７ａをピッチｄ＝４０μｍで配列した本例の場合、図４に示すように、プローブピン１１のフランジ上面１１ｂ’（直径８０μｍ）は常に完全な状態で数本の導電性極細線１７ａと接触することになる。因みに、５ｍｍ角の異方性導電シート１７には１００００本以上の導電性極細線１７ａが配列されることになる。

【００３３】なお、前記実施形態による異方性導電シート１７においては、シート状基材１７ｂの厚み方向に沿って垂直に延びるように導電性極細線１７ａを配列しているが、プローブピン１１とＬＳＩチップ２３の電極パッド２３ａとの接触に際しオーバードライブ時の導電性極細線１７ａに加わる力を緩和するために、異方性導電シート１７製造時に、レジスト膜２５にＸ線を斜め上方から照射することにより、シート状基材１７ｂ面に対して導電性極細線１７ａを傾斜させて配列するようにしてもよい。この時の傾斜角度は垂直に対して６０°以内が好ましい。また、ＬＳＩチップ２３の電気的諸特性の測定に高周波信号電流を用いると、電流が導電性極細線１７ａの表面を流れるので、該導電性極細線表面の電気抵抗を下げるために、図２の（ｅ）に示す段階にて各導電性極細線１７ａの表面を金または銀メッキするようにしてもよい。

【００３４】

【発明の効果】以上述べたように、本発明による異方性導電シートの製造方法によると、ＬＩＧＡプロセスを利用することによって、金属基板上に微細構造レジスト膜を有する導電性極細線群母型を形成し、電鋳法により該導電性極細線群母型を用いて導電性極細線群を形成するようにしたものであるから、従来とは違って、シート状基材中に導電性極細線群を配してなる微細構造を有し、プローブカードに用いられて半導体集積回路の微細化に対応しうる異方性導電シートを製造することができる。

【００３５】本発明によるプローブカードによると、シート状基材中に導電性極細線群を配してなる異方性導電シートを備えたものであるから、この異方性導電シートにより、プローブピン数の増加とそのプローブピン間のピッチの狭小化に対して対応することができるとともに、プローブピンの配列変更に対してもその都度作り直す必要がなくて汎用性を有し、これにより半導体集積回路の微細化に対応することができる。

【図面の簡単な説明】

【図１】本発明の一実施形態によるフローブカードの構成を示す模式的断面図である。

【図２】本発明の一実施形態による異方性導電シートの製造方法の手順を説明するための模式的断面図である。

【図３】本発明に係る異方性導電シートの製造方法における導電性極細線群母型の他の作製方法を説明するための模式的断面図である。

【図４】本発明に係る異方性導電シートの導電性極細線とプローブピンのフランジ上面との位置関係の一例を示す平面図である。

【図５】従来の垂直型のプローブカードの構成を示す模式的断面図である。

【符号の説明】

１０…プローブカード　１１…プローブピン　１１ａ…接触部　１１ｂ…フランジ　１１ｂ’…フランジ上面　１２…はんだ付け　１３…プローブピン支持板１３ａ…貫通孔　１４…プローブピンガイド板　１４ａ…貫通孔　１５…回路基板　１５ａ…下面側電極パッド　１５ｂ…上面側電極パッド　１６…スペーススブレッダー　１６ａ…下面側電極パッド　１６ｂ…上面側電極パッド　１７…異方性導電シート　１７ａ…導電性極細線群　１７ａ’…導電性極細線群　１７ｂ…シート状基材　１７

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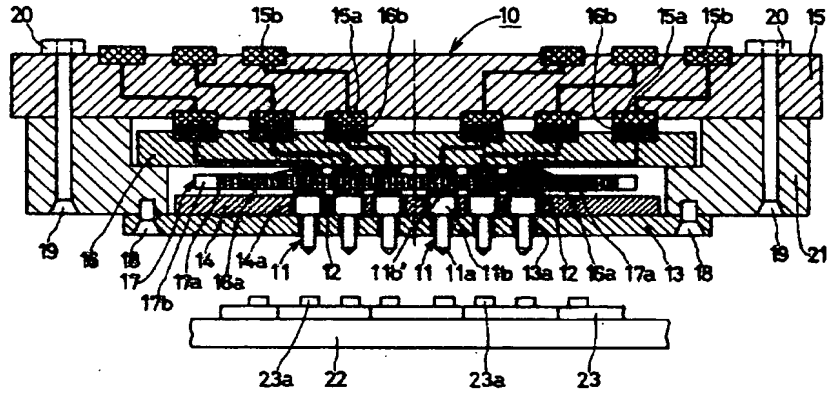
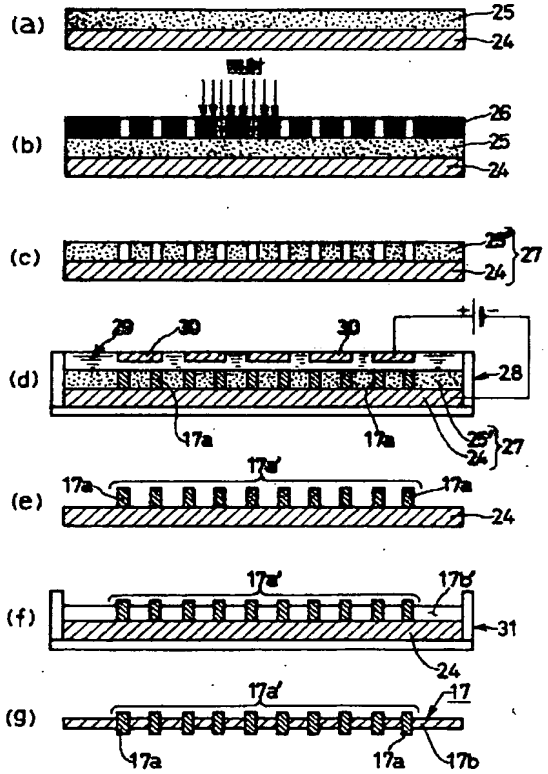
b’…シート状基材材料　１８…ねじ　１９…おねじ２０…めねじ　２１…支持脚部　２２…ウエハー載置台　２３…ＬＳＩチップ２３ａ…電極パッド　２４…金属基板　２５…レジスト膜　２５’…微細構造レジスト膜　＊２６…マスク　２７，２７’…導電性極細線群母型　２８…メッキ槽２９…メッキ液　３０…ニッケル電極　３１…型枠　３２…導電性極細線群形成用膜　３２’…微細構造膜

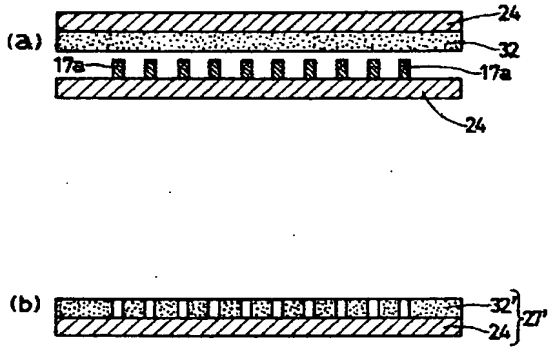
【図１】



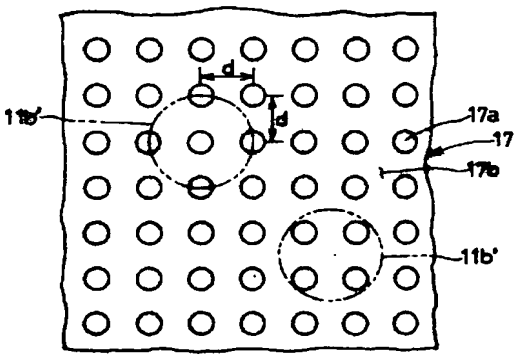
【図２】



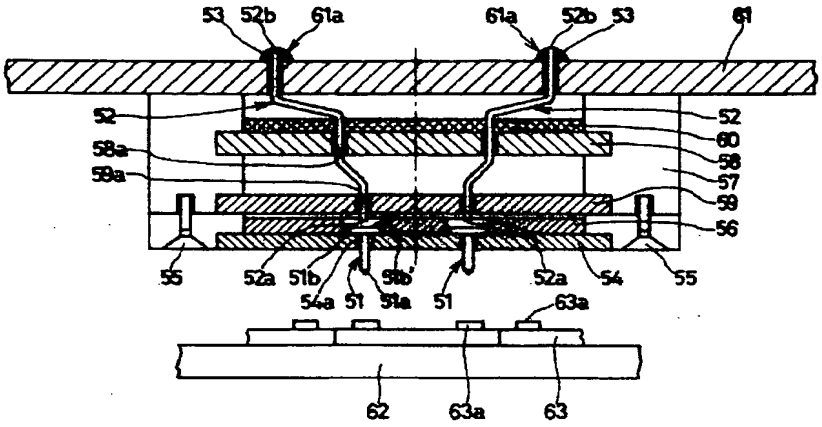
【図３】



【図４】



【図５】



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